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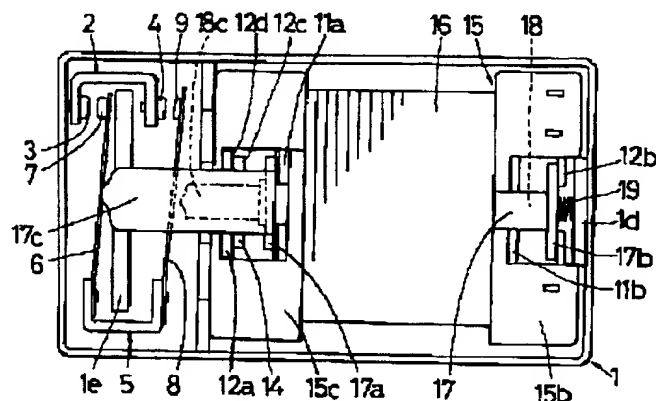
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APPLICANT : MATSUSHITA ELECTRIC WORKS LTD;

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TITLE : ELECTROMAGNETIC RELAY



ABSTRACT : PURPOSE: To provide an electromagnetic relay capable of increasing the contact time difference between arc contacts and low-resistance contacts, capable of prolonging the contact life, and not enlarged so much.

CONSTITUTION: When the first and second moving members 17, 18 are attracted to the opposite piece 12a of a yoke 10, both moving members 17, 18 are integrally operated until the first moving member 17 faces the first contact section 12c, and arc contacts 3, 7 are brought into contact. After the first moving member 17 is brought into contact with the first contact section 12c, only the second moving member 18 is operated until it is brought into contact with the second contact section 12d, and low-resistance contacts 4, 9 are brought into contact.

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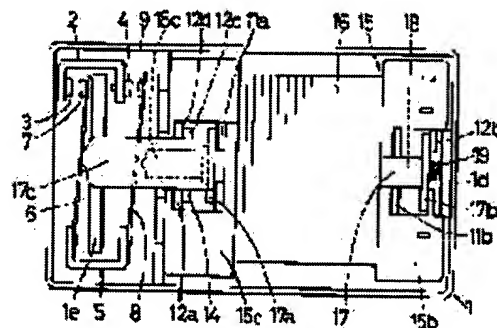
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(54) ELECTROMAGNETIC RELAY

(57)Abstract:

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CLAIMS

[Claim(s)]

[Claim 1] The yoke and the coil which passes magnetic flux to a yoke characterized by providing the following, while forming the remainder of a magnetic path -- the 1st ***** -- attaching and detaching -- the [and] -- the [which drives 1 traveling contact spring] -- with 1 movable member while forming the remainder of a magnetic path -- the 2nd ***** -- attaching and detaching -- the [and] -- the [which drives 2 traveling contact springs] -- with 2 movable member It is the electromagnetic relay it was made to operate until the 1st moving-part material ****(ed) to the 1st ***** until only the 2nd moving-part material ****(ed) it to the 2nd ***** , after both the movable member operated in one and the 1st moving-part material ****(ed) it to the 1st ***** in the case of operation which ***** and both the movable member **** to both ***** . The stationary-contact board which established the contact for arcs, and the low resistance contact. The 1st traveling contact spring which established the contact for arcs. The 2nd traveling contact spring which established the low resistance contact. The 1st and 2nd ***** which determine two actuated positions which are different while forming the traveling contact board which fixed the end face of both the traveling contact spring, and a part of magnetic path so that the contacts for arcs and low resistance contacts may attach and detach.

[Claim 2] It is the electromagnetic relay according to claim 1 to which most 2nd moving-part material has ***** by which the section was held in the inner direction of the 1st moving-part material in tubed [in which both the aforementioned movable member makes inner **** of a coil the plunger type formula which reciprocates, and the 1st moving-part material has *****] and which is formed cylindrically.

[Claim 3] The electromagnetic relay according to claim 1 or 2 which prepared the buffer member in the 1st ***** of the above.

[Claim 4] Both the aforementioned traveling contact spring is the electromagnetic relay according to claim 1 to 3 which it is installed [electromagnetic relay] so that it may counter mutually, and made insulating member intervene between both traveling contact springs.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Industrial Application] this invention relates to the suitable electromagnetic relay for opening and closing of the cable run where lighting fitting with which the big rush current flows was connected.

[0002]

[Description of the Prior Art] Contact arrangement, such as a general electromagnetic relay, carries out attachment-and-detachment operation of the traveling contact prepared in the stationary contact prepared in the stationary-contact board at the traveling contact spring. In this case, since the cable run is it a capacitor load and L load that they are opening and closing of the cable run where lighting fitting was connected, as shown in drawing 5, the big rush current flows. Since an arc occurs between contacts by this and welding becomes easy to take place, although it is desirable to use the oxidization contact and tungsten contact of Sn system for raising a welding-proof performance, if it does so, the contact resistance of a contact will become high and a temperature rise will pose a problem. That is, it becomes a conflicting requirement to raise a welding-proof performance and to suppress the temperature rise of a contact.

[0003] Then, while raising a welding-proof performance, in order to suppress the temperature rise of a contact, what uses together the contact for arcs according to each purpose and a low resistance contact is proposed variously. s (for example, JP,61-233919,A, JP,62-71137,A, JP,62-71138,A, etc.) . These pass it at the contact for arcs, when the rush current has occurred, and when it becomes the stationary current, it is made to pass it at a low resistance contact by making the contact for arcs open, after contacting a low resistance contact after the contact for arcs contacted previously, and making a low resistance contact open previously.

[0004]

[Problem(s) to be Solved by the Invention] Although a good result is obtained when time difference operation of change of current and both contacts has consistency, the adjustment is not necessarily easy for what uses together the above-mentioned contact for arcs, and a low resistance contact. That is, there is a danger that the rush current will flow also at a low resistance contact, and this will result in welding at the contact time of the contact for arcs and a low resistance contact when a difference decreases further by dispersion in a part size at the contact time, or there is no dispersion and the time of the rush current to flow is long since a difference is what decreases structurally. Moreover, these are complicated, or structure enlarges them and cannot apply them to an electromagnetic relay with the strong demand of a miniaturization easily.

[0005] this invention is what was made in view of the above-mentioned reason, a large difference can be taken at the contact time of the contact for arcs, and a low resistance contact, a contact life is made for a long time, and the place made into the purpose has it in offer of the electromagnetic relay which moreover is not enlarged so much.

[0006]

[Means for Solving the Problem] In order to solve this technical problem, the electromagnetic relay of this invention The stationary-contact board which established the contact for arcs, and the low resistance contact, and the 1st traveling contact spring which established the contact for arcs, The 2nd traveling contact spring which established the low resistance contact, and the traveling contact board which fixed the end face of both the traveling contact spring so that the contacts for arcs and low resistance contacts might attach and detach, A yoke with the 1st and 2nd ***** which determine two actuated positions which are different while forming a part of magnetic path, while forming the coil which passes magnetic flux to a yoke, and the remainder of a magnetic path -- the 1st ***** -- attaching and detaching -- the [and] -- the [which drives 1 traveling contact spring] -- with 1 movable member while forming the remainder of a magnetic path -- the 2nd ***** -- attaching and detaching -- the [and] -- the [which drives 2 traveling contact springs] -- with 2 movable member In the case of operation which ***** and both the movable

member **** to both *****, both the movable member operates in one, and it is constituted so that it may operate until only the 2nd moving-part material **** to the 2nd *****, after the 1st moving-part material **** to the 1st **** until the 1st moving-part material **** to the 1st *****.

[0007] Still more specifically, both the movable member makes inner **** of a coil the plunger type formula which reciprocates, and most 2nd moving-part material is taken as the composition to which the section has ***** held in the inner direction of the 1st moving-part material and which was formed cylindrically tubed [in which the 1st moving-part material has *****].

[0008] Moreover, it is desirable to prepare a buffer member in the 1st *****. moreover, it installs so that both the traveling contact spring may counter mutually -- having -- and between both traveling contact springs -- insulating member -- mediation **** -- things are desirable

[0009]

[Function] Since operate in one, both the movable member drawing in mutually according to the magnetic-attraction force, and suiting until the 1st moving-part material **** to the 1st ***** according to this composition, the contact for arcs is contacted previously, the 2nd moving-part material is attracted subsequently to the 2nd ***** and a low resistance contact is contacted, at the contact time of a contact for arcs, and low resistance contact, a difference is comparatively large and it can take.

[0010] If a buffer member is prepared in the 1st *****, it can slow down at the time of the second half of operation of both the movable member, a difference can take more greatly at the contact time of the contact for arcs, and a low resistance contact, and, moreover, collision sound will become small.

[0011] Moreover, if insulating member is made to intervene between both traveling contact springs, the influence by the arc to a low resistance contact side can be reduced.

[0012]

[Example] Hereafter, one example of this invention is explained based on drawing 1 and drawing 2.

[0013] 1 Lay each part material mentioned later with the ** base, and it is covering. (not shown) It covers and housing is constituted with covering by fixing. the support whose 1b 1a transfixes a stationary-contact board and transfixes a traveling contact board, respectively -- a hole, and 1c and 1c A spring retaining wall and 1e are yoke positioning projected parts, and 1d is an insulating wall.

[0014] 2 At *****, they are the pieces 2a and 2b of opposite. And it has KO ***** which consists of piece of connection 2c, and 2d of terminal areas formed successively from the central-site edge of piece of connection 2c. And the contact surface is made one piece of opposite 2a in the inner direction, and it is the contact 3 for arcs. The contact surface is made into the method of outside at piece of opposite 2b of another side, and it is the low resistance contact 4. It has fixed, respectively. Contact 3 for arcs At the contact material excellent in a welding-proof performance like the oxidization contact of Sn system, or a tungsten contact, it is the low resistance contact 4. It is formed in a low resistance contact material like silver or a silver alloy, respectively. this stationary-contact board 2 2d of terminal areas -- support -- a hole -- it is transfixed to 1a In addition, stationary-contact board 2 Base 1 You may carry out simultaneous fabrication.

[0015] 5 At *****, they are the pieces 5a and 5b of opposite. And it has KO ***** which consists of piece of connection 5c, and 5d of terminal areas formed successively from the central-site edge of piece of connection 5c. 6 With a **** 1 traveling-contact spring, it is the contact 3 for arcs at a nose of cam. Contact 7 for arcs attaching and detaching It has prepared. 8 With a **** 2 traveling-contact spring, it is the low resistance contact 4 at a nose of cam. Low resistance contact 9 attaching and detaching It has prepared. In this case, the 2nd traveling contact spring 8 It is the 1st traveling contact spring 6 about a spring constant. It is made smaller than it. Both [these] traveling contact springs 6 and 8 Contacts 3 and 7 for arcs Comrades and low resistance contacts 4 and 9 The end face is the traveling contact board 5 so that comrades may attach and detach. Each pieces 5a and 5b of opposite It is fixed, therefore these are installed so that it may counter mutually. this traveling contact board 5 5d of terminal areas -- support -- a hole -- it is transfixed to 1b In this case, the base 1 Insulating wall 1e is both the traveling contact springs 6 and 8. It will be in the state where intervened in between, therefore insulating member was made to intervene between both traveling contact springs. In addition, traveling contact board 5 Base 1 You may carry out simultaneous fabrication.

[0016] 10 is a yoke, consists of a permanent magnet 13 fastened to the KO character-like piece 11 of an inner direction yoke, the piece 12 of the method yoke of outside, and these, and forms a part of magnetic path. The pieces 11 of an inner direction yoke are the pieces 11a and 11b of opposite. It becomes ***** which attracts the movable member which the lateral surface mentions later. It is larger than the piece 11 of an inner direction yoke, and the pieces 12 of the method yoke of outside are the pieces 12a and 12b of opposite. It becomes ***** which attracts the movable member which a medial surface mentions later. Therefore, each pieces 11a and 12a of opposite Between and 11b.12b It

is a gap corresponding to the amount of displacement of a movable member in between. Moreover, it is one piece of opposite 12a of the piece 12 of the method yoke of outside that it is important in a yoke 10, in order to decide two actuated positions from which the movable member mentioned later differs. The 1st and 2nd ***** 12c and 12d It is making it have. this example -- one piece of opposite 12a the buffer covering the half grade of the origin to height -- a member 14 -- sticking -- the front face -- 1st ***** 12c and piece of opposite 12a an internal surface -- the 12d of the 2nd ***** -- it is carrying out As an option, it is piece of opposite 12a. It may be made a ** with the stage and two ***** may be formed.

[0017] 15 is a coil frame and is cylinder part 15a. They are Flanges 15b and 15c to the ends. The coil 16 for coming to have and passing magnetic flux around cylinder part 15a at a yoke 10 is wound. In one flange 15b, it is end-winding child 16a. Simultaneous fabrication is carried out and they are both the flanges 15b and 15c. Hollows 15d and 15d which position the piece 11 of an inner direction yoke to an inner direction point It is formed.

[0018] 17 is each pieces 11a and 12a of opposite to nothing and its ends about the shape of a cylinder which is the 1st moving-part material and reciprocates inner **** of a coil 16 15, i.e., a coil frame. Between and 11b. 12b Armature pieces 17a and 17b which are pinched in between and located It has. Two armature pieces 17a and 17b Armature piece 17a which is especially one side although it attaches and detaches by turns to each of this piece of opposite 1st ***** 12c of the piece 12 of the method yoke of outside It is made to have attached and detached. moreover, one armature piece 17a **** -- the 1st traveling contact spring 6 Piece of drive 17c made from the insulating material for driving It has attached. 18 is the pieces 11a and 12a of opposite to nothing and its end about the shape of a rod to which it is the 2nd moving-part material, and the section is held in the inner direction of the 1st moving-part material, and mostly reciprocates. Armature piece 18a which is inserted in between and located It has. This armature piece 18a Pieces 11a and 12a of opposite Although it attaches and detaches by turns, it is made to have attached and detached especially to the 12d of the 2nd ***** of the piece 12 of the method yoke of outside. moreover, this armature piece 18a **** -- the 2nd traveling contact spring 8 Piece of drive 18c made from the insulating material for driving It has attached. 19 is attached to 1d of spring retaining walls by the coiled spring for shock relief of the 1st moving-part material 17.

[0019] Both movable members 17 and 18 Inner **** of the coil frame 16 is made into the plunger type formula which reciprocates as mentioned above, therefore a magnetic path is formed with a yoke 10, and they are one armature pieces 17a and 18a. It is located in polymerization. When this energizes in a coil 16 and magnetic flux flows to a magnetic path, they are both the armature pieces 17a and 18a. It draws in and suits and is the specific section. (section where armature piece 18a is ****(ed) by the 12d of the 2nd ***** after armature piece 17a **** to 1st ***** 12c) It removes and operates in one. That is, both movable members 17 and 18 as shown in drawing 1 Return position (contact opening state) If a coil 16 is energized in the state of being Both movable members 17 and 18 In drawing, it moves to a left in one, and is piece of drive 17c first. The 1st traveling contact spring 6 It drives, the contacts 3 and 7 for arcs are contacted, and it is armature piece 17a soon. 1st ***** 12c ****(ing), the 1st moving-part material 17 stops. Subsequently, armature piece 18a The 12d of the 2nd ***** It is drawn in, only the 2nd moving-part material 18 moves further, and it is piece of drive 18c first. The 2nd traveling contact spring 8 It drives and they are the low resistance contacts 4 and 9. It is made to contact and is armature piece 18a soon. The 12d of the 2nd ***** It **** and the 2nd moving-part material 18 is also stopped.

[0020] drawing 3 (a), (b), and (c) **** -- composition is expressed typically and the operation is shown (a) They are both the movable members 17 and 18 as well as ****1. Return position (contact opening state) In the state of being, the state is maintained by the magnetic flux of a permanent magnet 12. If it energizes in a coil 16 so that magnetic flux may flow in the direction which negates the magnetic flux of a permanent magnet 12 in this state Armature pieces 17a and 18a ***** 12c and 12d It is drawn in and they are both the movable members 17 and 18. It moves to a left. Piece of drive 17c is the 1st traveling contact spring 6 first. It drives and they are the contacts 3 and 6 for arcs. It contacts and is (b) soon. It is armature piece 17a like. 1st ***** 12c ****(ing), the 1st moving-part material 17 stops. Subsequently, armature piece 18a The 12d of the 2nd ***** It is drawn in and only the 2nd moving-part material 18 moves to a left further. It is piece of drive 18c first. The 2nd traveling contact spring 8 It drives and they are the low resistance contacts 4 and 9. It contacts. It is (c) soon. It is armature piece 18a like. The 12d of the 2nd ***** It ****, the 2nd moving-part material 18 is also stopped, and they are both the movable members 17 and 18. Actuated position (contact contact state) It will be in the state of being. Even if it stops the energization to a coil 16 in this state, the state is maintained by the magnetic flux of a permanent magnet 12. if it energizes in a coil 16 at an opposite direction when returning to a return position from an actuated position -- the above and abbreviation -- reverse operation -- carrying out -- (a) It will be in a state.

[0021] Drawing 4 is the amount x of displacement (mm) to progress of time t (s). It is the property view showing speed

v (m/s) and load current I (A). x_1 -- the -- the variation rate of the 1 movable member 17, and x_2 -- the -- the variation rate of the 2 movable member 18, and v_1 -- the -- the speed of the 1 movable member 17, and v_2 -- the -- for the speed of the 2 movable member 18, and I_p , the peak current and I_o of the stationary current and t_1 are t_2 at the contact time of a low resistance contact at the contact time of the contact for arcs Change of the amount of displacement or speed is in the middle of of operation, and a large difference can be small taken by the bird clapper at the contact time between t_1 -2 so that clearly from this property view.

[0022] It faces making such operation perform and some consideration is required for the following point on a design. Namely, drawing 3 (b) It sets in the state and is armature piece 17a. Piece of opposite 12a It is armature piece 18a from the magnetic reluctance of a between. Piece of opposite 12a It is making the magnetic reluctance of a between small.

[0023] In addition, although both the movable member is the thing of the plunger type formula which reciprocates and explained inner **** of a coil in the example, it is applicable to clapper form. Moreover, when sound of operation does not become a problem, you may use a buffer member as a rigid-body-like member. Moreover, if the arc generated between the contacts for arcs is not so large, you may omit the insulating member between both traveling contact springs.

[0024]
[Effect of the Invention] Both the movable member drawing in mutually according to the magnetic-attraction force, and suiting until the 1st moving-part material **** the electromagnet equipment of this invention to the 1st *****, operate in one and the contact for arcs is contacted previously. the [subsequently,] -- since 2 movable member is attracted by the 2nd ***** and a low resistance contact is contacted, a difference can take comparatively greatly at the contact time of the contact for arcs, and a low resistance contact, therefore a contact life is made for a long time, and, moreover, it does not enlarge so much

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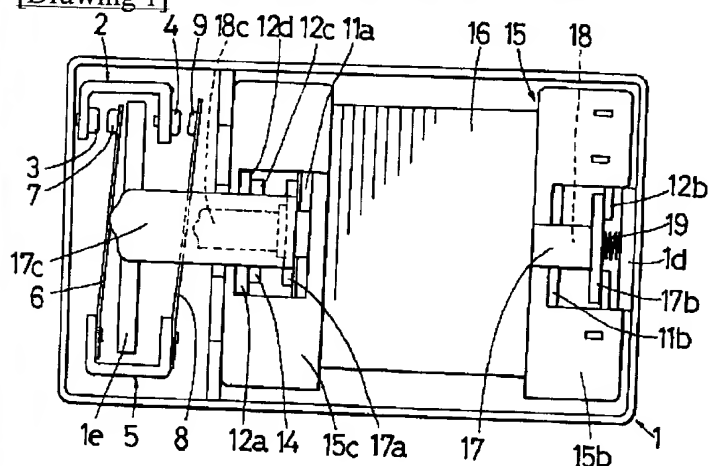
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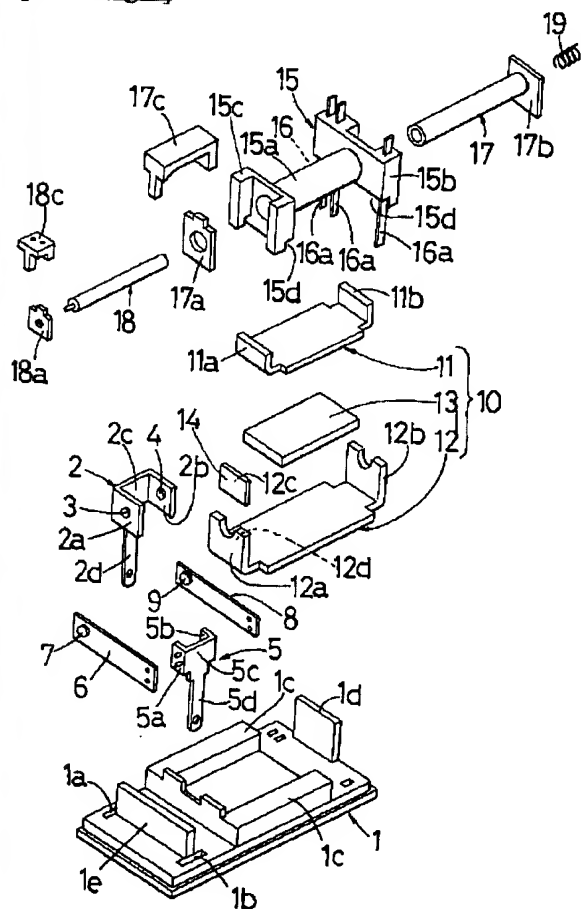
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DRAWINGS

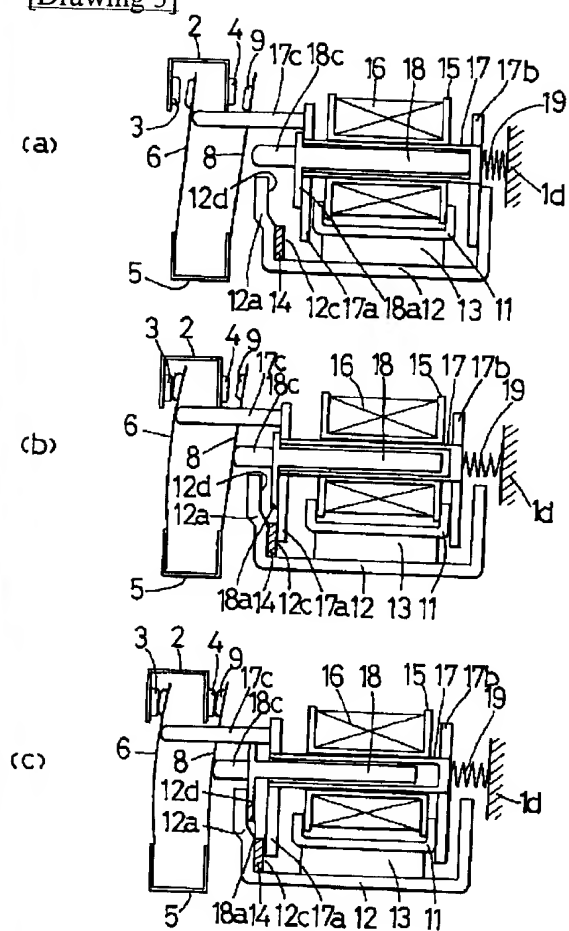
[Drawing 1]



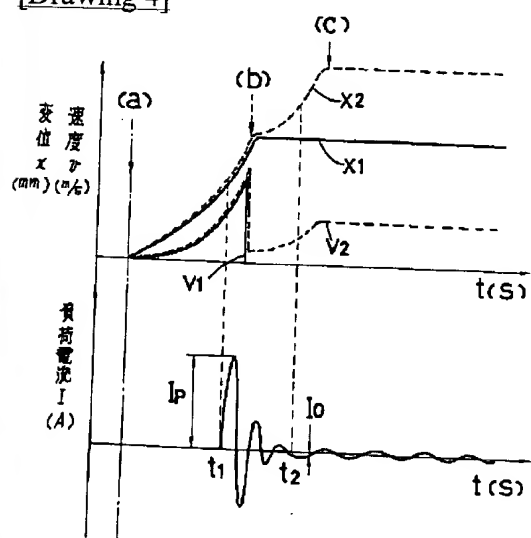
[Drawing 2]



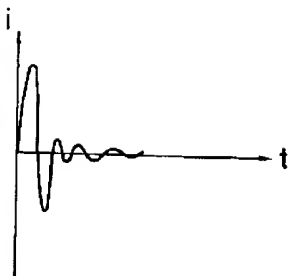
[Drawing 3]



[Drawing 4]



[Drawing 5]



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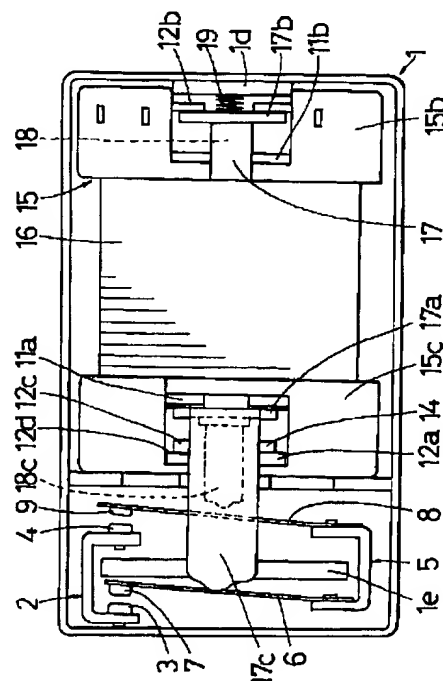
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(54) 【発明の名称】 電磁継電器

(57) 【要約】

【目的】 アーク用接点と低抵抗接点の接触時点差が大きくとれて接点寿命が長くでき、しかもそれほど大型化しない電磁継電器の提供。

【構成】 第1、第2可動部材17, 18 がヨーク10の対向片12a に吸引されるとき、第1可動部材17が第1の接極部12c に接極するまでは両可動部材は一体的に動作してまずアーク用接点3, 7 を接触させ、第1可動部材17が第1の接極部12c に接極した後は第2可動部材18のみが第2の接極部12d に接極するまで動作して低抵抗接点4, 9 を接触させるようにした。



1

【特許請求の範囲】

【請求項1】 アーク用接点及び低抵抗接点を設けた固定接点板と、アーク用接点を設けた第1可動接点ばねと、低抵抗接点を設けた第2可動接点ばねと、アーク用接点同士及び低抵抗接点同士が接離するよう両可動接点ばねの基端を固定した可動接点板と、磁路の一部を形成するとともに異なる2個の作動位置を決める第1及び第2の接極部を有したヨークと、ヨークに磁束を流すコイルと、磁路の残部を形成するとともに第1の接極部に接離しかつ第1可動接点ばねを駆動する第1可動部材と、磁路の残部を形成するとともに第2の接極部に接離しかつ第2可動接点ばねを駆動する第2可動部材と、を備え、両可動部材が両接極部に接極する動作の際、第1可動部材が第1の接極部に接極するまでは両可動部材は一体的に動作し、第1可動部材が第1の接極部に接極した後は第2可動部材のみが第2の接極部に接極するまで動作するようにした電磁継電器。

【請求項2】 前記両可動部材はコイルの内空部を往復動するプランジャ形式とし、第1可動部材は接極部を有する筒状に、第2可動部材は大半が第1可動部材の内方に收容された接極部を有する棒状に形成されている請求項1記載の電磁継電器。

【請求項3】 前記第1の接極部に緩衝部材を設けた請求項1又は2記載の電磁継電器。

【請求項4】 前記両可動接点ばねは互いに対向するよう並設され、かつ両可動接点ばね間に絶縁部材を介させた請求項1乃至3記載の電磁継電器。

【発明の詳細な説明】

【0001】

【産業上の利用分野】本発明は、大きな突入電流が流れる照明器具が接続された回路の開閉に好適な電磁継電器に関する。

【0002】

【従来の技術】一般的な電磁継電器等の接点装置は、固定接点板に設けた固定接点に可動接点ばねに設けた可動接点を接離動作させる。この場合、照明器具が接続された回路の開閉であると、その回路はコンデンサ負荷やし負荷であるため、図5に示すように大きな突入電流が流れる。これにより接点間にはアークが発生して溶着が起こり易くなるので、耐溶着性能を高めるにはSn系の酸化接点やタングステン接点を用いるのが望ましいが、そうすると接点の接触抵抗が高くなって温度上昇が問題となる。すなわち耐溶着性能を高めることと、接点の温度上昇を抑制することとは相反する要求になるのである。

【0003】そこで、耐溶着性能を高めるとともに接点の温度上昇を抑制するために、それぞれの目的に応じたアーク用接点と低抵抗接点とを併用するものが種々提案されている（例えば特開昭61-233919、特開昭62-71137、特開昭62-71138等）。これらは、アーク用接点が高いに接触した後に低抵抗接点を接触させ、また低抵抗接点

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を先に開離させた後にアーク用接点を開離させることにより、突入電流が発生しているときにはそれをアーク用接点に流し、定常電流になったときにはそれを低抵抗接点に流すようにしている。

【0004】

【発明が解決しようとする課題】上記したアーク用接点と低抵抗接点とを併用するものは、電流の変化と両接点の時間差動作が整合したときは良好な結果が得られるのであるが、その整合が必ずしも容易ではない。すなわちアーク用接点と低抵抗接点の接触時点差が構造的に少なくなるものであるために、部品寸法のばらつきによって接触時点差がさらに少なくなったり、あるいはばらつきが無い場合でも突入電流の流れる時間が長いときには低抵抗接点にも突入電流が流れてこれが溶着に至る危険性がある。またこれらは構造が複雑であったり大型化するもので小型化の要求が強い電磁継電器には適用しにくいものである。

【0005】本発明は、上記事由に鑑みてなしたもので、その目的とするところは、アーク用接点と低抵抗接点の接触時点差が大きくとれて接点寿命が長くでき、しかもそれほど大型化しない電磁継電器の提供にある。

【0006】

【課題を解決するための手段】かかる課題を解決するために、本発明の電磁継電器は、アーク用接点及び低抵抗接点を設けた固定接点板と、アーク用接点を設けた第1可動接点ばねと、低抵抗接点を設けた第2可動接点ばねと、アーク用接点同士及び低抵抗接点同士が接離するよう両可動接点ばねの基端を固定した可動接点板と、磁路の一部を形成するとともに異なる2個の作動位置を決める第1及び第2の接極部を有したヨークと、ヨークに磁束を流すコイルと、磁路の残部を形成するとともに第1の接極部に接離しかつ第1可動接点ばねを駆動する第1可動部材と、磁路の残部を形成するとともに第2の接極部に接離しかつ第2可動接点ばねを駆動する第2可動部材と、を備え、両可動部材が両接極部に接極する動作の際、第1可動部材が第1の接極部に接極するまでは両可動部材は一体的に動作し、第1可動部材が第1の接極部に接極した後は第2可動部材のみが第2の接極部に接極するまで動作するように構成してある。

【0007】さらに具体的には、両可動部材はコイルの内空部を往復動するプランジャ形式とし、第1可動部材は接極部を有する筒状に、第2可動部材は大半が第1可動部材の内方に收容された接極部を有する棒状に形成した構成としている。

【0008】また、第1の接極部に緩衝部材を設けることが好ましい。また、両可動接点ばねが互いに対向するよう並設され、かつ両可動接点ばね間に絶縁部材を介させることが好ましい。

【0009】

【作用】この構成によれば、第1可動部材が第1の接極

部に接極するまでは両可動部材は磁気吸引力により互いに吸引しあいつつ一体的に動作して先にアーク用接点を接触させ、次いで第2可動部材が第2の接極部に吸引されて低抵抗接点を接触させるので、アーク用接点と低抵抗接点の接触時点差が比較的大きくとれる。

【0010】また、第1の接極部に緩衝部材を設けると、両可動部材の動作後半時に減速できてアーク用接点と低抵抗接点の接触時点差がより大きくとれ、そのうえ衝突音が小さくなる。

【0011】また、両可動接点ばね間に絶縁部材を介在させると、低抵抗接点側に対するアークによる影響を低減することができる。

【0012】

【実施例】以下、本発明の一実施例を、図1及び図2に基づいて説明する。

【0013】1はベースで、後述する各部材を載置し、カバー（図示せず）を被せて固定することにより、カバーとともにハウジングを構成する。1aは固定接点板を、1bは可動接点板をそれぞれ貫通固定する支持孔、1c、1cはヨーク位置決め突部、1dはばね支持壁、1eは絶縁壁で

【0014】2は固定接点板で、対向片2a、2b及び連結片2cよりなるコ字状部と、連結片2cの中央側端より連設される端子部2dとを有する。そして一方の対向片2aには接触面を内方にしてアーク用接点3が、他方の対向片2bには接触面を外方にして低抵抗接点4がそれぞれ固着してある。アーク用接点3はSn系の酸化接点やタングステン接点のような耐溶着性能が優れた接点材料にて、低抵抗接点4は銀や銀合金のような低抵抗接点材料にてそれぞれ形成される。この固定接点板2は、端子部2dが支持孔1aに貫通固定される。なお、固定接点板2をベース1に同時成形してもよい。

【0015】5は可動接点板で、対向片5a、5b及び連結片5cよりなるコ字状部と、連結片5cの中央側端より連設される端子部5dとを有する。6は第1可動接点ばねで、先端にアーク用接点3に接離するアーク用接点7を設けている。8は第2可動接点ばねで、先端に低抵抗接点4に接離する低抵抗接点9を設けている。この場合、第2可動接点ばね8のばね定数を第1可動接点ばね6のそれより小さくする。これら両可動接点ばね6、8は、アーク用接点3、7同士及び低抵抗接点4、9同士が接離するようにその基端が可動接点板5の各対向片5a、5bに固定され、従ってこれらは互いに対向するように並設される。この可動接点板5は、端子部5dが支持孔1bに貫通固定される。この場合、ベース1の絶縁壁1eが両可動接点ばね6、8間に介在し、従って両可動接点ばね間に絶縁部材を介在させた状態となる。なお、可動接点板5をベース1に同時成形してもよい。

【0016】10はヨークで、コ字状の内方ヨーク片11、外方ヨーク片12そしてこれらに挟着された永久磁石13よ

りなり磁路の一部を形成する。内方ヨーク片11は、対向片11a、11bの外側面が後述する可動部材を吸引する接極部となる。外方ヨーク片12は、内方ヨーク片11より大きく、対向片12a、12bの内側面が後述する可動部材を吸引する接極部となる。従って各対向片11a、12a間、11b、12b間は可動部材の変位量に対応した間隙となっている。またヨーク10において重要なことは、後述する可動部材の異なる2個の作動位置を決めるために、外方ヨーク片12の一方の対向片12aに第1及び第2の接極部12c、12dを有するようにすることである。この実施例では、一方の対向片12aに根本から高さの半分程度にわたる緩衝部材14を貼着し、その表面を第1の接極部12c、対向片12aの内表面を第2の接極部12dとしている。別の方法として、対向片12aを段付状にして2個の接極部を形成してもよい。

【0017】15はコイル枠で、筒部15aとその両端に鈎部15b、15cを有してなり、筒部15aの周囲にヨーク10に磁束を流すためのコイル16が巻回してある。一方の鈎部15bにはコイル端子16aが同時成形されており、また両鈎部15b、15cの内方先端部には内方ヨーク片11を位置決めする凹所15d、15dが形成されている。

【0018】17は第1可動部材で、コイル16、すなわちコイル枠15の内空部を往復動する円筒状をなし、その両端に各対向片11a、12a間、11b、12b間に挟まれて位置する接極片17a、17bを有する。2個の接極片17a、17bは、この各対向片に交互に接離するのであるが、特に一方の接極片17aは外方ヨーク片12の第1の接極部12cに接離するようにしてある。また一方の接極片17aには、第1可動接点ばね6を駆動するための絶縁材料製の駆動片17cが取着してある。18は第2可動部材で、大半が第1可動部材の内方に収容されて往復動する棒状をなし、その一端に対向片11a、12a間に挟まれて位置する接極片18aを有する。この接極片18aは、対向片11a、12aに交互に接離するのであるが、特に外方ヨーク片12の第2の接極部12dに接離するようにしてある。またこの接極片18aには、第2可動接点ばね8を駆動するための絶縁材料製の駆動片18cが取着してある。19は第1可動部材17の衝撃緩和のためのコイルばねでばね支持壁1dに付設される。

【0019】両可動部材17、18は、上記のようにコイル枠15の内空部を往復動するブランジヤ形式とし、従ってヨーク10とともに磁路を形成し、一方の接極片17a、18aが重合的に位置している。これによりコイル16に通電して磁路に磁束が流れるとき、両接極片17a、18aは吸引しあい特定区間（接極片17aが第1の接極部12cに接極した後接極片18aが第2の接極部12dに接極される区間）を除いて一体的に動作する。つまり、図1に示すような両可動部材17、18が復帰位置（接点開離状態）にある状態でコイル16を通電すると、両可動部材17、18が一体的に図において左方へ移動し、まず駆動片17cが第1可動

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接点ばね6を駆動してアーク用接点3,7を接触させ、やがて接極片17aが第1の接極部12cに接極して第1可動部材17は停止する。次いで接極片18aが第2の接極部12dに吸引されて第2可動部材18のみがさらに移動し、まず駆動片18cが第2可動接点ばね8を駆動して低抵抗接点4,9を接触させ、やがて接極片18aが第2の接極部12dに接極して第2可動部材18も停止する。

【0020】図3(a)(b)(c)には、構成を模式的に表してその動作を示している。(a)は図1と同じく両可動部材17,18が復帰位置(接点分離状態)にある状態で、永久磁石12の磁束によってその状態を維持している。この状態において永久磁石12の磁束を打ち消す方向に磁束が流れるようコイル16に通電すると、接極片17a,18aが接極部12c,12dに吸引されて両可動部材17,18が左方へ移動し、まず駆動片17cが第1可動接点ばね6を駆動してアーク用接点3,6が接触し、やがて(b)のように接極片17aが第1の接極部12cに接極して第1可動部材17は停止する。次いで接極片18aのみが第2の接極部12dに吸引されて第2可動部材18のみがさらに左方に移動し、まず駆動片18cが第2可動接点ばね8を駆動して低抵抗接点4,9が接触し、やがて(c)のように接極片18aが第2の接極部12dに接極して第2可動部材18も停止し、両可動部材17,18は作動位置(接点接触状態)にある状態となる。この状態でコイル16への通電を停止しても永久磁石12の磁束によりその状態を維持する。作動位置から復帰位置に戻す場合は、コイル16に逆方向に通電すれば上記と略逆の動作をして(a)の状態となる。

【0021】図4は、時間 t (s)の経過に対する変位量 x (mm)、速度 v (m/s)、負荷電流 I (A)を示す特性図で、 x_1 は第1可動部材17の変位、 x_2 は第2可動部材18の変位、 v_1 は第1可動部材17の速度、 v_2 は第2可動部材18の速度、 I_p はピーク電流、 I_o は定常電流、 t_1 はアーク用接点の接触時点、 t_2 は低抵抗接点の接触時点である。この特性図から明らかなように、変位量あるいは速度の変化が動作途中で小さくなることにより t_1-t_2 間の接触時点差が大きくとれる。

【0022】このような動作を行わせるに際し、設計上次の点に若干の考慮が必要である。すなわち図3(b)の状態において、接極片17aと対向片12a間の磁気抵抗より接極片18aと対向片12a間の磁気抵抗の方を小さくすることである。

【0023】なお、実施例では両可動部材はコイルの内

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空部を往復動するプランジャ形式のもので説明したが、クラッパー形式のものにも適用できる。また動作音が問題にならない場合は緩衝部材を剛体状の部材にしてもよい。またアーク用接点間に発生するアークがそれほど大きくなければ、両可動接点ばね間の絶縁部材を省略してもよい。

【0024】

【発明の効果】本発明の電磁石装置は、第1可動部材が第1の接極部に接極するまでは両可動部材は磁気吸引力により互いに吸引しあいつつ一体的に動作して先にアーク用接点を接触させ、次いで第2可動部材が第2の接極部に吸引されて低抵抗接点を接触させるので、アーク用接点と低抵抗接点の接触時点差が比較的大きくとれ、従って接点寿命が長くでき、しかもそれほど大型化しないものとなる。

【図面の簡単な説明】

【図1】本発明の第1実施例を示す平面図である。

【図2】その分解斜視図である。

【図3】(a)(b)(c)は模式的に示した動作説明図である。

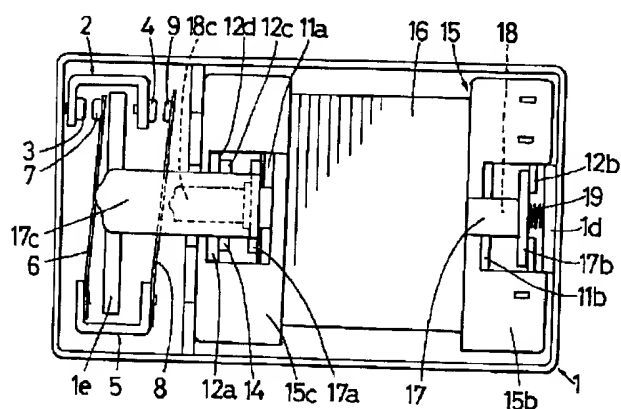
【図4】時間の経過に対する変位、速度特性曲線である。

【図5】一般的な突入電流の波形図である。

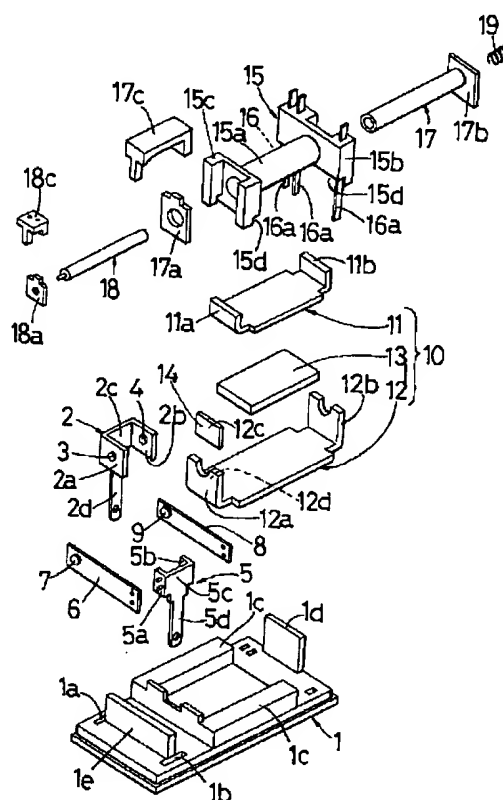
【符号の説明】

- 1 ベース
- 2 固定接点板
- 3 アーク用接点
- 4 低抵抗接点
- 5 可動接点板
- 6 第1可動接点ばね
- 7 アーク用接点
- 8 第2可動接点ばね
- 9 低抵抗接点
- 10 ヨーク(11内方ヨーク片、12外方ヨーク片、13永久磁石)
- 12c 第1の接極部
- 12d 第2の接極部
- 14 緩衝部材
- 15 コイル枠
- 16 コイル
- 17 第1可動部材
- 18 第2可動部材

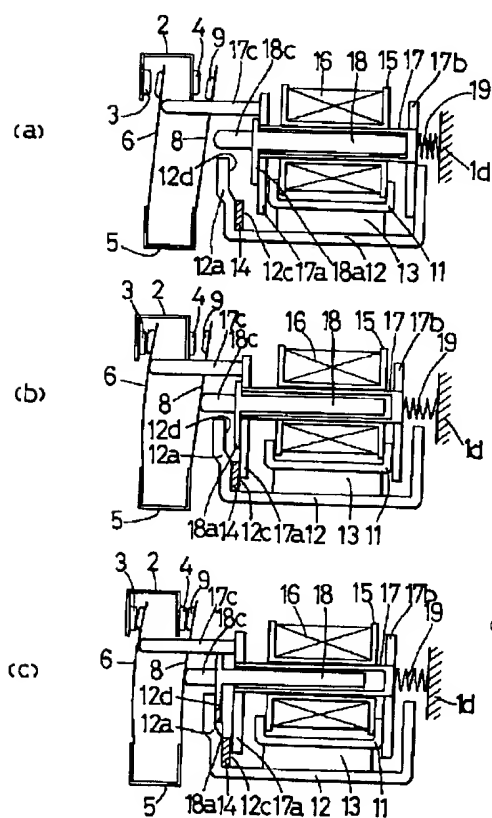
【図1】



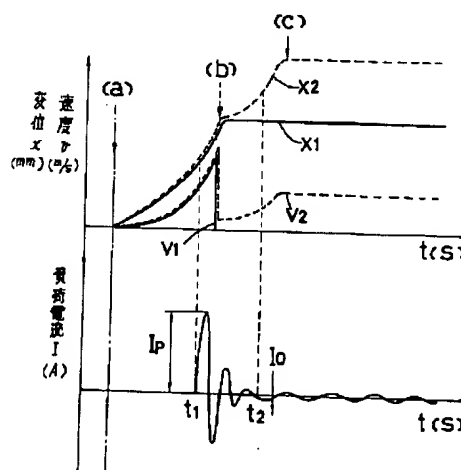
【図2】



【図3】



【図4】



(6)

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【図5】

